

Appendix A

Excerpts from "Comments of Time Domain Corporation, In the Matter of Revision of Part 15 of FCC's Rules Regarding Ultra Wideband Transmission Systems (ET Docket 98-153)" dated 7 December 1998.

Note: bold emphasis added, underlining contained in original text

"Ultra-wideband emitters are unlike traditional narrowband or wideband systems that can easily be frequency allocated and required to avoid intentionally emitting into the restricted bands. UWB bandwidths span several GigaHertz of spectrum, and similar to unintentional radiators, cannot be assigned to a frequency band outside of the restricted bands.

"The Commission has asked: if the restricted bands were retained, how would this affect the viability of UWB? **The restricted bands are very disruptive to the TM-UWB waveform**, and the performance degradation is dependent upon the application. **It is assumed that if restricted bands are retained that the only option available to UWB engineers would be to use notch filters to reduce the emissions within the restricted bands to field strengths below the already low limits of Part 15.**"

"Notch filters will significantly degrade UWB communications links and geo-ranging systems in various ways. By filtering out some of the energy along with spreading the energy in time, notch filters obviously decrease the signal available to the receiver, and thus decrease the signal to noise ratio. For communication systems, the decrease in bandwidth reduces processing gain resulting in reduced channel capacity. Also, because of the distorted pulse, the place on the waveform where the receiver is locked is no longer known as accurately and therefore the ranging and positioning capability has been decreased. The extended pulse also adversely affects the ability of ranging devices to determine with precision the time of arrival of the first arriving signal associated with the direct path. Further, when the notch filters spread and distort the pulse in time, the bandwidth effectively decreases and the UWB system suffers unrecoverable losses of two major benefits multipath immunity and jamming resistance. The UWB system becomes as vulnerable to fading effects and multipath problems as are wideband and narrowband systems. As for jamming immunity, UWB performance suffers in two ways: (1) energy has been taken away from the available signal and (2) the pulse has been distorted and lengthened, thereby weakening correlation properties and resistance to interference. **As a result, notching drastically reduces or completely nullifies all of the factors, which make UWB technology a unique and superior solution.**

"The impact of notch filters on radar equipment is more severe than experienced in communication and geo-ranging systems. The distortion caused by notch filters effectively extends the duration of the pulse. This artifact degrades the range resolution prized by UWB systems. It also produces sidelobes in the radars response, which will significantly degrade advanced processes such as imaging and object identification. Once again, **the viability of UWB for radar applications would be greatly impaired by notch filters.**"



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"Furthermore, one of the key factors for the commercial viability of UWB technology is the low cost of implementation, which results from processes that may not be simple, but are substantially digital – leading to highly integrated ASIC designs. **A requirement for notch filters, which cannot be implemented easily in ASIC form compromises the size, weight, and cost factors for UWB products. The consumer ultimately pays the price for unnecessary filters in significantly reduced performance, reduced convenience, and increased cost.**"

"Notwithstanding this definitional issue, however, notching would be so disruptive as to render most UWB applications unfeasible."